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Abstract

The establishment of a monetary union in Europe in 1999 has eliminated exchange rate risk within the euro area and has led to a more unified financial framework. It has been established in the literature that the euro has led to a disproportional increase in bilateral asset holdings within the euro area. This paper builds on this evidence and answers the question whether this has been a one-off effect, or whether the euro effect in intra-euro area bilateral asset holdings has changed over time. We show, using a gravity framework, that the proportional increase in bilateral asset holdings took place in the early years of the European monetary union and was a unique event. The data used are bilateral data on equity and bond holdings, provided by the Coordinated Portfolio Investment Survey of the IMF for the years 1997, and 2001 until 2006.

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1 Introduction

The creation of a monetary union in Europe has, by definition, eliminated bilateral exchange rate volatility within the euro area. Since the single market program of 1992 and the start of the Maastricht process, financial integration has accelerated within Europe (Freixas, Hartmann and Mayer, 2004). Monetary union has further increased unification in the institutional structure of asset markets within the European monetary union. Already one year after the establishment of the European Monetary Union (EMU), Danthine, Giavazzi and Von Thadden (2001) concluded that the EMU has had a favourable effect on European financial market integration. Bond markets within the euro area are now highly integrated, whereas equity markets remain more segregated (Jappelli and Pagano, 2007).

Reduced exchange rate volatility and more integrated financial markets might lead to an increase in intra euro area bilateral asset holdings. It has been established in the literature that the creation of the EMU has led to a shift towards euro area in international investment patterns for bonds and equity by euro countries (Lane and Milesi-Ferretti (2008), Lane (2006) and Coeurdacier and Martin (2007)). In this paper, we want to find out whether the shift in investment behaviour, triggered by the euro, has been a gradual process or whether it has been a one-off shift at the start of the EMU.

According to the international capital asset pricing model, it is optimal for an international investor to hold the world market portfolio. In reality, investors do not behave in this way. Barriers to international investment prevent this. There might be barriers to investing in foreign assets. Also, there might larger barriers to holding assets of one country compared to barriers to holding assets of another foreign country. The first issue leads to the so-called home bias in international asset holdings: countries tend to relatively overinvest in domestic assets. The second issue might explain the geographical pattern of international asset holdings. If the costs of acquiring assets in a certain country are relatively low, more assets might be held there. Costs of international asset trade can arise due to a very wide range of issues: informational and cultural barriers, exchange rate risk, technical transaction costs such as fees and commissions per trade, legal barriers such as capital controls, differences in tax treatment and differences in security trading systems and settlement systems. A distinction between fixed and variable costs can be made. Differences in trading systems and legal systems can be considered as fixed costs, while fees and commissions for transactions can be interpreted as variable costs (Martin and Rey, 2000).

The creation of a currency union has removed barriers to asset trade within the euro area. It has directly removed all costs related to exchange rate risk. At the same time informational barriers have been reduced. Within the euro area, monetary unification has led to further integration of bond markets because it has triggered a sequence of policy actions and private-sector responses that removed many of the obstacles that

prohibited European bond market integration (see Pagano and von Thadden (2004) for a discussion of the evolution in European bond markets since monetary unification). Public bond markets have become more unified, and at the same time there has been a major growth in the corporate bond market in Europe. There has also been an evolution in international consolidation of equity markets (although this process has not happened within the euro area). A more unified financial structure might have reduced the real cost of asset trade. A more important channel might have been the reduction in information asymmetries as a consequence of bond market integration (and equity market integration).

It has been shown that information plays an important role in the geographical allocation of asset holdings. Kang and Stulz (1997) show that investors are more likely to hold equity in large firms, because they provide more and better quality information. Portes and Rey (1998, 2005) investigate cross-border equity flows and argue that information is the main determinant of international patterns in portfolio equity flows. Ahearne, Grier and Warnock (2004) find that information costs play an important role in explaining the home bias in US equity investment. Coval and Moskowitz (2001) find that fund managers earn abnormal returns in nearby investments because investors who trade local securities might have an informational advantage.¹

Both the reduction in exchange rate risk and the easing of informational constraints might have led to greater within euro area asset holdings since the construction of the euro area.

The first to consider the effect of monetary union membership on bilateral asset holding are Lane and Milesi-Ferretti (2008) for equity and Lane (2006) for bilateral bond holdings. They use bilateral asset data provided by the Coordinated Portfolio Investment Survey (CPIS) from the IMF. These authors find that European monetary integration has led to increased asset holdings within the euro area. This effect is stronger for bonds than for equity. Coeurdacier and Martin (2009) assess the euro effect on bonds, equity and bank assets, using Coordinated Portfolio Investment Survey (CPIS) data and data from the Bank of International Settlements (BIS). The methodology used in these papers is an empirical gravity framework, well-known from the trade literature. De Santis and Gérard (2006), on the other hand, assess the same question using a portfolio framework constructing portfolio weights. Comparing portfolio weights in 1997 and 2001, they find a reduction in home bias in many countries. This decline is more pronounced for euro area countries. Aviat, Coeurdacier and De Santis (2009) find a positive EMU effect on cross-border merger and acquisitions in the manufacturing sector, but not for services. Focusing on FDI, Petroulas (2007) finds that the introduction of the euro has increased inward FDI by around 16% within the euro area. Spiegel (2009) shows, using a difference-in-differences approach, that Greece and Portugal increasingly borrow from EMU member coun-

¹The same authors (1999) show that within national borders, there is a local bias, because of asymmetric information between local and nonlocal investors.

tries since the establishment of the euro area.

The research on the link between a currency union and bilateral asset holdings is related to the empirical work on the general determinants of bilateral capital flows, which started with the paper by Portes and Rey (2005). Bilateral equity flow data between 1989 and 1996 is used to assess the determinants of international asset trade. Aviat and Coeurdacier (2007) use BIS data on asset holdings, and focus on both trade in goods and assets at once.²

This paper belongs to the the first branch of research using a gravity model to evaluate the impact of the euro on patterns in international asset holdings. The main contribution of this paper is the introduction of a time dimension. The research by Lane and Milesi-Ferretti (2008), Lane (2006) and Coeurdacier and Martin (2007) has indicated that there has been an increase in bilateral asset holdings within the euro area by analysing data at one point in time. Our analysis tests whether this has been a one-off effect, or whether the euro effect is getting stronger (or weaker) over time. Exchange rate risk has been removed directly when the euro was introduced, but the reduction of informational barriers caused by the more unified financial markets has been a gradual process. Therefore, it is possible that the shift by euro area members for holding a disproportional amount of other euro area assets has evolved gradually over time as well. To assess this question, we analyse a panel between 2001 and 2008 and estimate whether there has been a change in the euro effect.

It has been established in the literature that there is a euro effect in international asset holdings: countries that are member of the euro area hold proportionally more assets in other euro countries controlling for other determinants of bilateral asset holdings. In this paper we show that the euro bias in bonds held by euro members is due to a one-off change in bilateral investment patterns. After 2001, there has been no statistically significant change in the euro bias. The euro effect within the euro area is stronger for bond holdings than for equity. We show that the shift to euro area assets held by euro area members cannot be explained by the reduction in exchange rate risk. A reduction in the trade barriers arising from information asymmetries might be behind the observed euro effect. This indicates that informational barriers and a more unified financial structure play an important role in shaping cross-border asset holdings.

In what follows we present the data from the Coordinated Portfolio Investment Survey, the estimation model, the data and some econometric issues. This is followed by a presentation of the estimation results, robustness checks and a general conclusion.

²They also make use of CPIS data as a robustness check.

2 The Coordinated Portfolio Investment Survey

A detailed description of the data and its limitations can be found in Lane and Milesi-Ferretti (2008). The CPIS data is based on surveys carried out by the IMF in cooperation with the participating countries. It gives a detailed overview of the asset holdings of the participating country (we refer to this country as the host country) by residence of the issuer (we refer to the issuing country as the destination country). The asset holdings are divided into equity, long-term debt (we refer to this as bonds) and short-term debt. The first survey took place in 1997 with a limited number of host countries. From 2001 onwards, data is published yearly for a wider range of host countries. The most recent data currently available refer to 2008.

3 Estimation model

A gravity equation for international asset holdings has been derived from a theoretical model of asset trade by several authors, for example by Lane and Milesi-Ferretti (2008) and Coeurdacier and Martin (2007). In the derived gravity equation bilateral asset holdings are determined by the economic sizes of the source and host countries and transaction costs.

We estimate two equations with a panel of 22 source countries and 167 host countries between 2001 and 2008. The panel consists of the 11 EMU member countries and 11 other advanced economies that function as a control group. The 11 EMU countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Spain and Portugal. We follow Lane (2006) in using a control group of countries that are similar in level of economic development and institutions to the EMU group: Australia, Canada, Denmark, Iceland, Japan, Norway, New Zealand, Sweden, Switzerland, United Kingdom and the United States. An overview of the source and host countries in the sample can be found in the Appendix. Countries classified as offshore centers are removed.³

$$Debt_{ijt} = \alpha_{it} + \alpha_{jt} + \alpha_t + \beta_t EMU_{ijt} + \gamma VOLEX R_{ijt} + \theta X_{ijt} + \epsilon_{ijt} \quad (1)$$

$$Equity_{ijt} = \alpha_{it} + \alpha_{jt} + \alpha_t + \beta_t EMU_{ijt} + \gamma VOLEX R_{ijt} + \theta X_{ijt} + \epsilon_{ijt} \quad (2)$$

³The removed offshore centers are Andorra, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Costa Rica, Cyprus, Democratic Republic of Congo, Dominica, Gibraltar, Grenada, Guernsey, Isle of Man, Jersey, Lebanon, Liechtenstein, Luxembourg, Macau, Malta, Marshall Islands, Mauritius, Monaco, Netherlands Antilles, Niue, Palau, Panama, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Samoa, Seychelles, St. Lucia, Turks and Caicos Islands and Vanuatu.

$Equity_{ijt}$: Bilateral equity holdings held by country i (the host country) in country j (the destination country).

$Debt_{ijt}$: Bilateral bonds holdings held by country i in country j. Long term debt assets, mainly bonds, are debt assets with maturity more than one year.

EMU_{ijt} : Indicator variable that takes value 1 if both country i and country j are in euro area

$VOLEXR_{ijt}$: Yearly bilateral exchange rate volatility during the current year and the three previous years between country i and country j measured as $VOL_{ij} = STDEV[d(\log(s_{ij}))]$. For EMU members $VOLEXR_{ijt}$ is set to zero for all year 2001-2008. For example, for the year 2001, exchange rate volatility is based on monthly bilateral exchange rate date starting in 1998 up to 2001. This measure of bilateral exchange rate volatility has been proposed by Devereux and Lane (2003).

X_{ijt} : Matrix of control variables: European Union membership, bilateral trade, common colonizer, (former) colony, adjacency, common official language and distance.

To implement this model we estimate the following equations:

$$Debt_{ijt} = \alpha_{it} + \alpha_{jt} + \alpha_t + \beta EMU_{ijt} + \gamma_{0t} EMU_{ijt} \theta_t + \gamma VOLEXR_{ijt} + \theta X_{ijt} + \epsilon_{ijt} \quad (3)$$

$$Equity_{ijt} = \alpha_{it} + \alpha_{jt} + \alpha_t + \beta EMU_{ijt} + \gamma_{0t} EMU_{ijt} \theta_t + \gamma VOLEXR_{ijt} + \theta X_{ijt} + \epsilon_{ijt} \quad (4)$$

The dependent variable $Equity_{ij}$ and $Bond_{ij}$ are bilateral asset holdings of the source country held in the host country, provided by the CPIS. Data is available for the years 2001 to 2008. The 2008 data are preliminary data.

Host country and source country fixed effects are included in the model to control for unobserved host country and source country characteristics that influence the level of bilateral asset holdings. They are allowed to change over time. As such they can account for time effects that are specific to certain countries. By including these time-varying host and source country fixed effects no time-varying country specific variables such as GDP can be included. Time fixed effects for each year are also included. These will capture an overall time trend in bilateral asset holdings. A measure of the economic size of the host and

source country is not included as the fixed effects capture all country specific characteristics. X_{ij} is a matrix of control variables.

The main variable of interest is the EMU_{ij} dummy. If membership of the euro area by both host and source country increases the level of their bilateral asset holdings controlling for other factors, then the coefficient on the EMU dummy will be positive and significant. As we are interested in the change over time in the effect of membership of the euro area, the coefficient on the EMU dummy is allowed to change per year.

The geographic pattern of bilateral asset holdings is determined by exchange rate risk and transaction costs. Opportunities for risk sharing are another factor that might influence international portfolio holdings with countries holding more assets in countries with which there is a lower correlation in asset returns. In the previous literature using gravity equations to estimate bilateral asset holdings several control variables have been proposed (see Aviat and Coeurdacier (2007), Lane and Milesi-Ferretti (2008), Lane (2006), Martin and Coeurdacier (2007) and Portes and Rey (2005) for bilateral equity flows). To capture cultural closeness and low informational barriers distance, time difference, past colonial relationship, language and legal origin have been introduced. The presence of a tax treaty between two countries is another variable that has been used. Finally, to capture patterns in bilateral asset that arise from international risk sharing the correlation in growth rates or the correlation in stock market returns has been included.

We choose to include most of these variables as control variables.⁴ A higher degree of exchange rate risk might affect bilateral asset holdings negatively. We include a measure of bilateral exchange rate variability in equation (3) and equation (4). To capture informational barriers and cultural closeness we include several dummy variables. An indicator variable that takes on value 1 when both the host and the source country are members of the European Union is added as a control variable.⁵ Bilateral distance enters as it is a proxy for informational asymmetries. Further we include a dummy variable that takes the value 1 if one country has colonised the other country in the past, a dummy variable that takes the value 1 if the two countries are adjacent and a dummy variable that takes the value 1 if they have a common official language. Finally, a measure of bilateral trade is included. Bilateral trade might also be a proxy for informational barriers. It is measured as the log of the imports into the host country. The coefficients on the control variables are set to be constant as it is not unlikely to assume that the effect of for example, having a common language or sharing a border has remained constant between 2001 and 2008.

A detailed description of the data and the data sources can found in the Appendix.

⁴When we did not include a common variable such as legal origin the main reason that is reduces the country sample considerably.

⁵For the years 2001, 2002 and 2003 this is the EU15, from 2004 EU25.

4 Econometric Issues

As a large number of the observations of bilateral asset holdings are zero, the log linear form of the regression equation as implied by the gravity structure can be problematic. Even if we do not derive the empirical specification from theory, the logarithmic transformation is desirable as it reduces the dispersion of our variables. This problem has been discussed in the gravity literature on trade in goods and assets. Several solutions have been proposed: reducing the sample to nonzero observations, transform the data (for example adding a constant), using censored Tobit regression and using poisson quasi-maximum likelihood estimation. There are advantages and disadvantages to every method.

When reducing the sample to nonzero observations, the log transformation can be applied at the cost of reducing the sample size.

Adding a constant to the data on the other hand, makes it possible to retain the zero observations.

Third, approaching the observations as coming from a censored sample and using Tobit estimation, entails the assumption that negative bilateral asset holdings are mapped to zero. Wooldridge (2002) argues that the Tobit model is appropriate for censored data as well as for data in which the dependent variable is zero with positive probability but is a continuous random variable over strictly positive values. The disadvantage is that negative values in the bilateral asset data holdings are present. Moreover, the Tobit model suffers from the incidental parameters problem.⁶ Greene (2004) shows that the Tobit Maximum Likelihood estimator has no bias in the coefficients. The estimates of the disturbance variance is biased, but Greene shows that this bias is small if the number of time periods is greater than or equal to five.

The last possibility is using a poisson quasi-maximum likelihood estimation method. In this case the dependent variable is the level of bilateral asset holdings. Santos Silva and Tenreyro (2006, 2009) argue that, for gravity equations in goods trade, the required log transformation invalidates OLS. The empirical gravity equation in the trade literature is usually derived by taking logarithms of the multiplicative form of the theoretical gravity equation. Therefore the error term in the empirical gravity equation is equal to the logarithm of the stochastic deviation from theory. They argue that the variance of this deviation will be correlated with the other regressors, invalidating the requirement for consistency that the conditional expectation of the error term is not correlated with the other regressors. They propose a poisson estimator instead. This method developed for count models can be used for non-count dependent variables as well (Wooldridge, 1999). Wooldridge (1999) shows that the fixed effect quasi-maximum likelihood poisson estimator is fully

⁶This problem arises because the estimator of the fixed effects relies on increasing number of time periods. But, including more observations in such a panel, leads to the inclusion of one more fixed effect. Therefore, the estimates of the fixed effects do not converge.

robust. Only the structural conditional mean assumption needs to be valid:

$$E(y|x) = \exp(x\beta)$$

for consistency and asymptotic normality. Standard errors robust to heteroskedasticity and serial correlation can be computed. Santos Silva and Tenreyro argue that this estimator is specifically suited to estimate gravity type equations for trade models. It removes the zero observation problem, as the dependent variable does not need a logarithmic transformation. In a consequent paper Santos Silva and Tenreyro address the existence problem of the maximum likelihood estimates that arises when applying poisson estimation to a panel with a dependent variable that contains many zero's and many dummy variables (Santos Silva and Tenreyro, 2009).

In this paper we choose to remove zero observations from the sample. This allows us to use the logarithmic transformation of the dependent variable without needing to add a constant. When adding a constant, the choice of the constant is arbitrary while it affects the distribution of the variables. In this case, the estimation results are sensitive to the chosen constant and scaling of the dependent variable. Therefore we remove the zero observations from the sample.

5 Estimation results

The results for the estimation of the gravity equation for bilateral bond holdings (equation 3) are presented in Table 4. The estimation method is Ordinary Least Squares with robust standard errors clustered on the destination country. The sample excludes all zero bilateral bond holdings. For bonds, the point estimates of the EMU dummy are positive and significant. If both the host and source country are euro area members, the bilateral bond holdings are 88% higher (point estimate 0.63) than would be expected from the other variables in the equation in 2001. The EMU dummy interacted with the time dummies for the years 2002-2008 are not significant indicating that there has been no significant change over time in the coefficient of the EMU dummy. See Figure 1 for the evolution over time of the coefficient on the EMU dummy. EMU countries hold a disproportionate amount of bonds in other EMU countries in 2001 and this has not changed since then. More bilateral exchange rate volatility decreases the amount of bilateral bond holdings as does the distance between the two countries. Deeper trade links and a past colonial relationship increases the bilateral bond holdings.

In column (2) in Table 4 the estimation results from estimating equation 4 are presented. Euro area countries proportionally invest more in equities in other euro area countries, although this effect remains

much in 2001 than the bond effect. For equities the euro effect is smallest in 2001, although the marginal time effects for the EMU dummy are not significant for all years, they are always positive. This means that the euro effect for bilateral equity holdings is not constant over time. Again, see Figure 1 for the evolution over time of the coefficient on the EMU dummy. They range from 71% in 2001 and a maximum of 160% in 2005. Membership of the European Union has a negative effect, controlling for other factors. Exchange rate volatility does not seem to have an effect on bilateral equity holdings while trade, distance, colonial relationships and a common language all have the expected signs.

We conclude that there is a significant effect of the host and source country being euro area members on the level of bilateral bond holdings. The effect is constant for the time period 2001-2008. The shift towards holding euro area bonds for euro area members has been a one-off effect at the start of the introduction of the euro. Being a member of the euro area also affects the geography of equity investment in our sample, but the effect is more volatile over the years.

6 Robustness checks

6.1 Yearly cross-sections

In this section we present the estimation results using the same specification, using yearly cross-section instead of panel data. By doing this, the coefficients on all explanatory variables are allowed to change over time. The results are presented in Table 5 for bonds and Table 6 for equities. The results for bonds confirm the panel estimation results: the EMU dummy is significant in each year and has not changed much over time. Bilateral exchange rate volatility reduces bilateral bond holdings as before (although it is not significant in all years). The other explanatory variables have the same sign as in the panel estimation although again, the variables are not significant in every year.

For equities (see Table 6), the EMU dummy in 2001 has a similar size as in the panel estimation and is also significant. The EMU dummy is also significant for the other years 2002 till 2008. This means that the finding that the euro effect for equities was smallest in 2001 and has increased in the later years is confirmed. Though it is important to note that the increase has not been gradual: in every year since 2001, the coefficient on the EMU dummy is larger than in 2001 but there have been increases and decreases over time. Regarding the other explanatory variables we can again conclude that the signs of the coefficients are similar to the ones found in the panel estimation but the coefficients are not significant in each year.

6.2 Comparison with pre-euro period: year 1997

A potential problem with the previous analysis is that the positive effect of euro area membership on bilateral asset holdings might exist for reasons due to other characteristics present in EMU members, and not due to the monetary union itself. To test whether this might be an issue, we analyse CPIS data for 1997. This is the only CPIS data available before the establishment of the euro area. In 1997 the first CPIS was constructed with a limited number of participants. From the 22 host country sample, Germany, Greece and Switzerland did not participate in the 1997 survey. We add German data for 1997 that were kindly provided to us by the Bundesbank. We estimate the same specification as we did for the years 2001-2008 (see equation (3) and equation (4)).

The sample of source countries that participated in the CPIS in 1997 is more limited than in the period 2001-2008. We use the 1997 sample (plus Germany) for both the 1997 and the 2001-2008 regressions to keep the comparability as high as possible. Also, in 1997 many bilateral asset holdings are reported to be zero, while starting in 2001 the same country pairs have no observations. This means there is a much higher number of zero observations in the 1997 sample. But as we estimate both the 1997 and the 2001-2008 regressions excluding zero observations this might not be a big issue. In any case we have to keep in mind that the 1997 survey is only a trial survey so the estimation results are not perfectly comparable with the results using 2001-2008 data.

First, we present the estimation results for 1997 and 2001-2008 based on the 1997 country sample plus Germany in Table 7 for bonds and Table 8 for equities. The euro effect is a lot smaller in 1997 than in 2001-2008 for bond holdings (a coefficient on the euro dummy of 0.39 in 1997 versus coefficients around 0.8 for the period 2001-2008). It is also only significant at the 10% level while for the other years there is significance at the 1% level. This indicates that the large euro effect found in the years 2001-2008 is partly due to membership of the EMU, and not purely due to other intrinsic characteristics that EMU countries have in common. For equity holdings (see Table 8) there is a small euro effect that is significant at the 10% level in 1997. Countries that will adopt the euro already hold a disproportionate amount of equity assets in other euro area countries in 1997.

These results indicate that intrinsic characteristics of the euro area might explain a small part of the observed euro bias in bilateral asset holdings. In the mean time it is possible that the observed small euro bias in 1997 is caused by the expectation of the creation of the euro area in 1999. In any case, the euro bias is much larger since 2001 indicating that the establishment of the euro as such has played a distinct role in increasing bilateral asset holdings among euro area countries.

6.3 Limited sample: 22 destination countries

As a final robustness check we estimate equation (3) and equation (4) with both the host as well as the destination countries limited to the 22 country sample. In this way, both host and destination countries consist of a group of countries that are structurally similar. The estimation results can be found in Table 9 for both bilateral bond holdings and bilateral equity holdings. For bond holdings we still find that Euro area countries hold a larger amount of bonds in other euro area countries, controlling for other deterministic. This effect is now larger than in the more limited sample with a point estimate of 0.74 in this case versus 0.63 in the base sample. The euro effect is still constant over time. The euro effect for bilateral equity holdings on the other hand is much larger than before in 2001 with a point estimate of 0.92 for the more limited sample versus 0.54 for the base sample. The effect is even bigger in 2002, but around the same level of 2001 for 2003-2008. The volatile pattern over time of the euro effect for equity holdings we found before is not confirmed using this more limited sample.

We can conclude that the euro effect for bilateral bond holdings is robust to the chosen country sample. The size of the effect is similar and it is constant over time. For equity holdings, a positive euro effect is also found in all cases. But the evolution over time since 2001 of the effect is not robust to the chosen sample.

7 Comparison with existing literature

Lane and Milesi-Ferretti (2008) assess the role of the establishment of the European monetary union on international equity holdings using data on bilateral asset holdings gathered by the CPIS in 2001. Lane (2006) does the same for bond holdings in 2004. Finally, Martin and Coeurdacier (2007) use bond and equity data in 2001 from CPIS, and BIS data on international banking assets for 2001. Our results are similar to the ones found by these other authors for bond holdings. Both Lane and Milesi-Ferretti (2008) and Martin and Coeurdacier (2007) find a relatively strong positive effect of euro area membership on bilateral bond holdings within the euro area. The euro effect on equity found in this paper is not smaller than for bond holdings, which is consistent with the findings of Lane and Milesi-Ferretti (2008) and Martin and Coeurdacier (2007).

8 Conclusion

It has been established in the literature that euro area countries exhibit a euro bias in the sense that they invest proportionally more in other euro area countries, controlling for other determinants of bilateral asset holdings. For bonds, the euro effect is present in 2001, and has not undergone a statistically significant

change since then. This result is independent of the chosen estimation method or sample. This implies that the euro effect in bilateral bond holdings within the euro area is due to a one-off change in investment behaviour by investors based in the euro area.

The euro effect is still in place when controlling for exchange rate volatility. This means that the euro effect is not due to the elimination of exchange rate risk. A reduction in the trade barriers arising from information asymmetries might be behind the observed euro effect. This indicates that informational barriers and a more unified financial structure play an important role in shaping cross-border asset holdings.

The euro effect on bilateral equity holdings for the periods 2001-2008 is smaller than the effect on bilateral bond holdings and follows an irregular pattern over time.

In 1997, countries that will join the euro area already hold relatively more bonds and equity within the euro area. This means that the observed euro bias in the 2001-2008 data might be caused for a small part by intrinsic characteristics that the euro group of countries have in common that leads them to invest a disproportionate amount in each other. But, the euro effect is much larger from 2001 onwards indicating that the introduction of the euro has played a distinct role.

As European bond markets have become structurally more integrated than equity markets since the adoption of the euro, the stronger euro effect for bond holdings is not unexpected.

We can conclude that the construction of the euro area has had a significant impact on geographical patterns of bilateral holdings of bonds. Euro area countries hold a disproportionate amount of bonds and equity in other euro area countries. For bonds this has been a one-off shift in the portfolios of euro area investors. For equity, the evolution over time in the euro effect has been more volatile.

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A Data Sources

Bilateral asset holdings: Coordinated Portfolio Investment Survey (CPIS): "Equity securities comprise all instruments and records acknowledging, after the claims of all creditors have been met, claims on the residual values of incorporated enterprises. Shares, stocks, participations or similar documents (such as American Depositary Receipts) usually denote ownership of equity. Long-term debt securities cover instruments such as bonds, debentures, and notes that usually give the holder the unconditional right to a fixed money income or contractually determined variable money income and have an original term to maturity of more than one year. Short-term debt securities cover treasury bills, commercial paper, and bankers' acceptances that generally give the holder the unconditional right to a stated fixed sum of money on a specified date. These instruments are usually traded on organized markets at a discount and have an original term to maturity of one year or less." All expressed in millions of US dollars, yearly 1997 and 2001-2008.

Bilateral exchange rate volatility: Authors' calculation based on monthly exchange rate data of domestic currency versus SDR from IMF International Financial Statistics, monthly, 1986-2006 (end of period). Yearly bilateral exchange rate volatility during the current year and the three previous years between country i and country j measured as $VOL_{ij} = STDEV[d(\log(s_{ij}))]$. For EMU members $VOLEXR_{ijt}$ is set to zero for all year 2001-2008. For example, for the year 2001, exchange rate volatility is based on monthly bilateral exchange rate data starting in 1998 up to 2001. This measure of bilateral exchange rate volatility has been proposed by Devereux and Lane (2003).

Bilateral import and export data: IMF Direction of Trade Statistics (Imports, c.i.f. Reporting Countries). in millions of US dollar, yearly 2001-2006.

Bilateral distance, colonial links, adjacency, language: Distance database from CEPII, <http://www.cepii.fr/francgraph/bdd/distances.htm>. Distance measured used in the estimations is 'distw', distance calculated the general formula developed by Head and Mayer (2002)

Stock market capitalization/GDP, Private Bond Market Capitalization/GDP, Public Bond Market Capitalization/GDP: Thorsten Beck, Asli Demirg-Kunt and Ross Levine, (2000), "A New Database on Financial Development and Structure," World Bank Economic Review 14, 597-605.

GDP: GDP in current US\$, World Development Indicators.

Table 1: source country (22)

Australia	Italy
Austria	Japan
Belgium	Netherlands
Canada	New Zealand
Denmark	Norway
Finland	Portugal
France	Spain
Germany	Sweden
Greece	Switzerland
Iceland	United Kingdom
Ireland	United States

Table 2: host country (167)

host country (167)				
Afghanistan	Cote d'Ivoire	Iceland	Morocco	Spain
Albania	Croatia	India	Mozambique	Sri Lanka
Algeria	Cuba	Indonesia	Myanmar	Sudan
Angola	Czech Republic	Iran	Namibia	Suriname
Argentina	Denmark	Iraq	Nepal	Swaziland
Armenia	Djibouti	Ireland	Netherlands	Sweden
Australia	Dominican Republic	Israel	New Caledonia	Switzerland
Austria	Ecuador	Italy	New Zealand	Syria
Azerbaijan	Egypt	Jamaica	Nicaragua	Tajikistan
Bangladesh	El Salvador	Japan	Niger	Tanzania
Belarus	Equatorial Guinea	Jordan	Nigeria	Thailand
Belgium	Eritrea	Kazakhstan	Norway	Togo
Benin	Estonia	Kenya	Oman	Tonga
Bhutan	Ethiopia	Kiribati	Pakistan	Trinidad & Tobago
Bolivia	Faeroe Islands	Korea, Dem. Rep.	Papua New Guinea	Tunisia
Bosnia & Herzegovina	Fiji	Korea, Rep.	Paraguay	Turkey
Botswana	Finland	Kuwait	Peru	Turkmenistan
Brazil	France	Kyrgyz Republic	Philippines	Uganda
Brunei Darussalam	French Polynesia	Lao People's Dem.Rep	Poland	Ukraine
Bulgaria	Gabon	Latvia	Portugal	United Arab Emirates
Burkina Faso	Gambia, The	Lesotho	Qatar	United Kingdom
Burundi	Georgia	Liberia	Romania	United States
Cambodia	Germany	Libya	Russia	Uruguay
Cameroon	Ghana	Lithuania	Rwanda	Uzbekistan
Canada	Greece	Macedonia	Sao Tome & Principe	Venezuela
Cape Verde	Greenland	Madagascar	Saudi Arabia	Vietnam
Central African Republic	Guatemala	Malawi	Senegal	Yemen
Chad	Guinea	Malaysia	Sierra Leone	Yugoslavia
Chile	Guinea-Bissau	Maldives	Singapore	Zambia
China,P.R.: Mainland	Guyana	Mali	Slovak Republic	Zimbabwe
Colombia	Haiti	Mauritania	Slovenia	
Comoros	Honduras	Mexico	Solomon Islands	
Congo, Dem. Rep. of	Hong Kong	Moldova	Somalia	
Congo, Republic of	Hungary	Mongolia	South Africa	

Table 3: Offshore countries

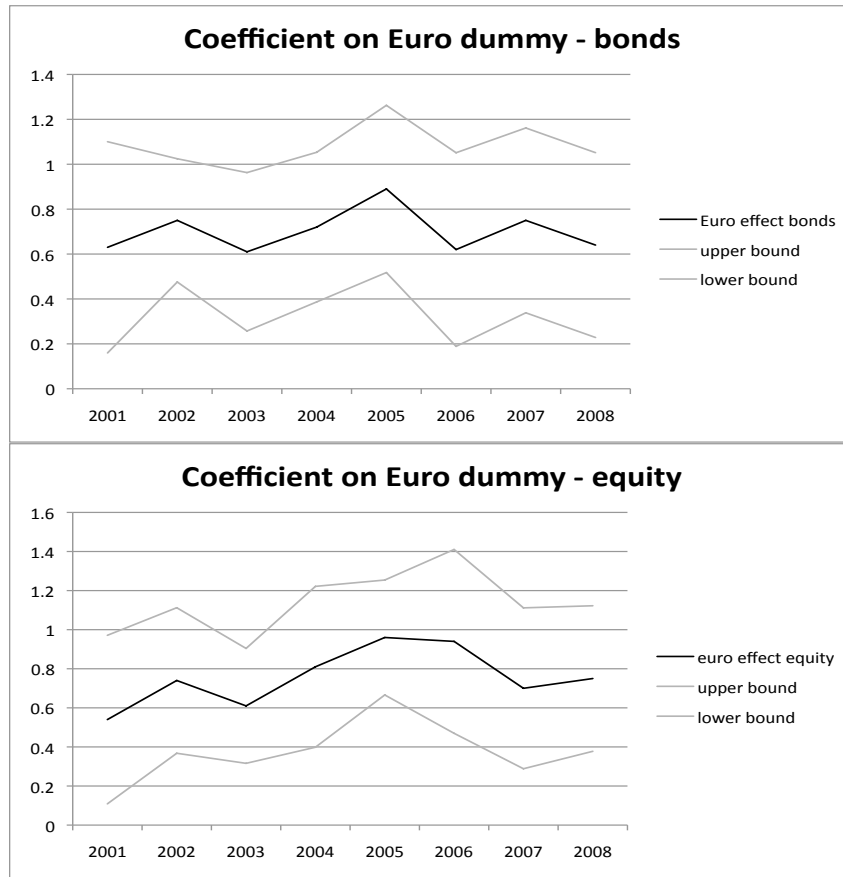
Andorra	Jersey
Anguilla	Lebanon
Antigua and Barbuda	Liechtenstein
Aruba	Luxembourg
Bahamas	Macau
Bahrain	Malta
Barbados	Marshall Islands
Belize	Mauritius
Bermuda	Monaco
British Virgin Islands	Netherlands Antilles
Cayman Islands	Niue
Cook Islands	Palau
Costa Rica	Panama
Cyprus	Saint Kitts and Nevis
Democratic Republic of Congo	Saint Vincent and the Grenadines
Dominica	Samoa
Gibraltar	Seychelles
Grenada	St. Lucia
Guernsey	Turks and Caicos Islands
Isle of Man	Vanuatu

Table 4: Panel Estimation

VARIABLES	(1) Bonds	(2) Equity
EMU	0.63** (0.24)	0.54** (0.24)
EMU 2002	0.12 (0.14)	0.20 (0.13)
EMU 2003	-0.02 (0.18)	0.07 (0.13)
EMU 2004	0.09 (0.17)	0.27* (0.14)
EMU 2005	0.26 (0.19)	0.42*** (0.16)
EMU 2006	-0.01 (0.22)	0.40** (0.17)
EMU 2007	0.12 (0.21)	0.16 (0.17)
EMU 2008	0.01 (0.21)	0.21 (0.18)
EU	0.17 (0.19)	-0.44** (0.19)
exchange rate volatility	-0.20*** (0.07)	0.09 (0.08)
log(import)	0.19*** (0.06)	0.45*** (0.07)
log(distance)	-0.49*** (0.10)	-0.31*** (0.12)
colony	0.36** (0.17)	0.51*** (0.17)
common language	0.24 (0.16)	0.40*** (0.14)
border	-0.10 (0.20)	0.11 (0.22)
Constant	3.10* (1.66)	-8.49*** (1.96)
Observations	9492	9071
R-squared	0.85	0.87
Adj. R-squared	0.830	0.854

Estimations using OLS with robust standard errors clustered on the host country. * significant at 10%; ** significant at 5%; *** significant at 1%. All estimations include time fixed effects and time-varying source and host country fixed effects.

Figure 1: Evolution over time of coefficient on Euro dummy
dummy graph.pdf



Based on panel estimations. Coefficient on EMU dummy with a 95% confidence interval.

Table 5: Yearly cross-sections 2001-2008: Bonds

VARIABLES	2001	2002	2003	2004	2005	2006	2007	2008
EMU	logltda 0.89*** (0.25)	logltda 0.82*** (0.21)	logltda 0.85*** (0.22)	logltda 0.55** (0.27)	logltda 0.68** (0.29)	logltda 0.72** (0.29)	logltda 0.61** (0.26)	logltda 0.69** (0.27)
EU	0.19 (0.25)	0.10 (0.21)	-0.43** (0.21)	0.48 (0.32)	0.14 (0.37)	-0.26 (0.30)	0.49 (0.30)	0.35 (0.26)
exchange rate volatility	-0.03 (0.09)	-0.19** (0.10)	-0.24*** (0.08)	-0.23** (0.11)	-0.40*** (0.10)	-0.30** (0.12)	-0.20 (0.13)	-0.10 (0.09)
log(import)	0.22*** (0.08)	0.10 (0.08)	0.18** (0.08)	0.19** (0.09)	0.26*** (0.07)	0.26*** (0.07)	0.23*** (0.08)	0.06 (0.11)
log(distance)	-0.64*** (0.14)	-0.66*** (0.14)	-0.63*** (0.15)	-0.41*** (0.15)	-0.13 (0.13)	-0.27** (0.14)	-0.36*** (0.13)	-0.70*** (0.16)
colony	0.34* (0.20)	0.62*** (0.23)	0.30 (0.23)	0.24 (0.23)	0.28 (0.22)	0.34 (0.22)	0.45** (0.21)	0.34 (0.25)
common language	0.41* (0.22)	0.02 (0.21)	0.11 (0.21)	0.16 (0.22)	0.14 (0.23)	0.36* (0.20)	0.26 (0.17)	0.39** (0.19)
border	-0.33 (0.24)	-0.21 (0.23)	-0.34 (0.23)	-0.07 (0.23)	0.17 (0.22)	0.11 (0.22)	-0.03 (0.23)	-0.06 (0.25)
Constant	1.88 (2.39)	4.86** (2.30)	2.99 (2.42)	1.28 (2.66)	-3.12* (1.69)	0.42 (2.07)	-0.85 (2.20)	6.85** (3.31)
Observations	1085	1087	1130	1137	1176	1275	1323	1279
R-squared	0.85	0.85	0.86	0.85	0.85	0.84	0.85	0.83
Adj. R-squared	0.828	0.835	0.836	0.836	0.836	0.821	0.832	0.813

Estimations using OLS with robust standard errors. * significant at 10%, ** significant at 5%, *** significant at 1%. All estimations include time fixed effects and source and host country fixed effects.

Table 6: Yearly cross-sections 2001-2008: Equity

VARIABLES	2001	2002	2003	2004	2005	2006	2007	2008
EMU	0.61** (0.30)	1.03*** (0.27)	0.91*** (0.21)	0.67*** (0.24)	0.90*** (0.22)	0.97*** (0.22)	0.64*** (0.22)	0.62** (0.25)
EU	-0.52** (0.21)	-0.83*** (0.23)	-1.20*** (0.23)	-0.11 (0.30)	-0.21 (0.25)	-0.45 (0.30)	-0.26 (0.27)	-0.23 (0.23)
exchange rate volatility	0.09 (0.10)	0.15 (0.10)	0.02 (0.08)	0.09 (0.12)	0.14 (0.12)	0.11 (0.13)	0.13 (0.14)	0.06 (0.10)
log(import)	0.52*** (0.09)	0.49*** (0.08)	0.35*** (0.09)	0.41*** (0.09)	0.53*** (0.10)	0.43*** (0.12)	0.55*** (0.08)	0.29*** (0.09)
log(distance)	-0.12 (0.14)	-0.30** (0.15)	-0.46*** (0.14)	-0.32** (0.16)	-0.19 (0.16)	-0.42** (0.20)	-0.28** (0.14)	-0.48*** (0.15)
colony	0.13 (0.23)	0.13 (0.22)	0.27 (0.25)	0.40 (0.24)	0.43* (0.22)	0.82*** (0.24)	0.84*** (0.25)	0.92*** (0.26)
common language	0.55*** (0.17)	0.65*** (0.19)	0.40** (0.18)	0.36* (0.19)	0.54** (0.22)	0.20 (0.27)	0.32* (0.19)	0.20 (0.23)
border	0.11 (0.22)	0.14 (0.25)	0.21 (0.22)	0.02 (0.27)	0.12 (0.27)	0.03 (0.28)	-0.06 (0.26)	0.31 (0.31)
Constant	-11.46*** (2.55)	-12.02*** (2.46)	-5.29** (2.49)	-5.94** (2.88)	-8.68*** (3.03)	-4.19 (3.50)	-6.72*** (2.40)	-0.91 (2.81)
Observations	1084	1037	1085	1074	1154	1217	1244	1176
R-squared	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.85
Adj. R-squared	0.866	0.858	0.867	0.855	0.856	0.850	0.852	0.826

Estimations using OLS with robust standard errors. * significant at 10%, ** significant at 5%, *** significant at 1%. All estimations include time fixed effects and source and host country fixed effects.

Table 7: Yearly cross-sections 1997, 2001-2008: Bonds

VARIABLES	1997	2001	2002	2003	2004	2005	2006	2007	2008
EMU	logltda 0.39* (0.22)	logltda 0.98*** (0.25)	logltda 0.91*** (0.21)	logltda 0.89*** (0.23)	logltda 0.74*** (0.27)	logltda 0.92*** (0.27)	logltda 0.87*** (0.28)	logltda 0.83*** (0.26)	logltda 0.87*** (0.27)
EU	logltda 0.64** (0.30)	logltda 0.33 (0.29)	logltda 0.21 (0.24)	logltda -0.30 (0.24)	logltda 0.68** (0.34)	logltda 0.32 (0.38)	logltda -0.12 (0.34)	logltda 0.72** (0.35)	logltda 0.51* (0.30)
exchange rate volatility	logltda -0.22** (0.10)	logltda -0.03 (0.09)	logltda -0.21** (0.10)	logltda -0.25*** (0.09)	logltda -0.24** (0.11)	logltda -0.40*** (0.11)	logltda -0.29** (0.12)	logltda -0.16 (0.13)	logltda -0.12 (0.10)
log(import)	logltda 0.21** (0.10)	logltda 0.15* (0.08)	logltda 0.04 (0.09)	logltda 0.15 (0.09)	logltda 0.15 (0.10)	logltda 0.20*** (0.07)	logltda 0.26*** (0.07)	logltda 0.19** (0.09)	logltda 0.04 (0.12)
log(distance)	logltda -0.33** (0.16)	logltda -0.70*** (0.15)	logltda -0.69*** (0.15)	logltda -0.63*** (0.16)	logltda -0.32** (0.16)	logltda -0.10 (0.15)	logltda -0.19 (0.15)	logltda -0.30* (0.15)	logltda -0.62*** (0.18)
colony	logltda 0.26 (0.21)	logltda 0.37* (0.19)	logltda 0.70*** (0.25)	logltda 0.35 (0.25)	logltda 0.32 (0.24)	logltda 0.36 (0.23)	logltda 0.33 (0.23)	logltda 0.47** (0.22)	logltda 0.37 (0.26)
common language	logltda 0.02 (0.21)	logltda 0.48** (0.21)	logltda 0.03 (0.22)	logltda 0.13 (0.22)	logltda 0.15 (0.22)	logltda 0.13 (0.23)	logltda 0.39* (0.20)	logltda 0.30 (0.19)	logltda 0.46** (0.20)
border	logltda 0.17 (0.23)	logltda -0.53** (0.23)	logltda -0.34 (0.23)	logltda -0.40* (0.24)	logltda -0.16 (0.23)	logltda 0.06 (0.22)	logltda -0.04 (0.23)	logltda -0.15 (0.23)	logltda -0.19 (0.25)
Constant	logltda 0.32 (2.76)	logltda 3.42 (2.43)	logltda 6.07** (2.68)	logltda 3.43 (2.85)	logltda 0.85 (2.86)	logltda -2.64 (1.97)	logltda -3.27 (2.10)	logltda -1.14 (2.59)	logltda 3.00 (3.51)
Observations	911	982	981	1010	1056	1070	1171	1208	1173
R-squared	0.84	0.86	0.86	0.86	0.86	0.86	0.84	0.85	0.84
Adj. R-squared	0.811	0.836	0.838	0.838	0.840	0.838	0.820	0.833	0.816

Estimations using OLS with robust standard errors. * significant at 10%, ** significant at 5%, *** significant at 1%. All estimations include time fixed effects and source and host country fixed effects.

Table 8: Yearly cross-sections 1997, 2001-2008: Equity

VARIABLES	1997	2001	2002	2003	2004	2005	2006	2007	2008
EMU	0.37* (0.21)	0.64** (0.31)	1.09*** (0.29)	1.01*** (0.23)	0.80*** (0.24)	1.03*** (0.23)	1.19*** (0.24)	0.73*** (0.24)	0.82*** (0.26)
EU	-0.78*** (0.25)	-0.52** (0.23)	-0.90*** (0.28)	-1.36*** (0.27)	-0.15 (0.33)	-0.10 (0.28)	-0.31 (0.31)	-0.33 (0.32)	-0.35 (0.26)
exchange rate volatility	-0.08 (0.11)	0.05 (0.11)	0.13 (0.11)	-0.03 (0.09)	0.06 (0.12)	0.13 (0.13)	0.14 (0.13)	0.03 (0.16)	0.01 (0.10)
log(import)	0.32*** (0.09)	0.48*** (0.08)	0.43*** (0.08)	0.30*** (0.08)	0.37*** (0.10)	0.45*** (0.10)	0.40*** (0.11)	0.51*** (0.08)	0.21** (0.08)
log(distance)	-0.31** (0.16)	-0.12 (0.14)	-0.34** (0.16)	-0.51*** (0.14)	-0.33* (0.17)	-0.22 (0.18)	-0.37* (0.21)	-0.25 (0.16)	-0.51*** (0.17)
colony	0.88*** (0.29)	0.15 (0.22)	0.16 (0.23)	0.28 (0.26)	0.45* (0.25)	0.33 (0.23)	0.76*** (0.24)	0.90*** (0.26)	1.02*** (0.27)
common language	0.44* (0.23)	0.64*** (0.17)	0.70*** (0.20)	0.46** (0.19)	0.35* (0.20)	0.67*** (0.23)	0.41 (0.25)	0.30 (0.19)	0.22 (0.23)
border	0.08 (0.25)	0.05 (0.23)	0.14 (0.28)	0.11 (0.24)	-0.04 (0.30)	-0.03 (0.25)	-0.17 (0.28)	-0.22 (0.25)	0.10 (0.30)
Constant	-5.40** (2.52)	-11.09*** (2.41)	-11.05*** (2.49)	-4.07 (2.45)	-5.70* (3.12)	-7.27** (3.00)	-4.42 (3.48)	-6.26** (2.45)	0.67 (2.84)
Observations	977	985	948	998	1009	1046	1108	1141	1083
R-squared	0.87	0.89	0.88	0.89	0.88	0.88	0.88	0.88	0.86
Adj. R-squared	0.845	0.869	0.860	0.873	0.859	0.861	0.861	0.860	0.835

Estimations using OLS with robust standard errors. * significant at 10%, ** significant at 5%, *** significant at 1%. All estimations include time fixed effects and source and host country fixed effects.

Table 9: Panel Estimation: host countries limited to 22 country sample

VARIABLES	(1) Bonds	(2) Equity
EMU	0.74** (0.30)	0.93*** (0.22)
EMU 2002	-0.04 (0.13)	0.50** (0.19)
EMU 2003	-0.17 (0.15)	0.23 (0.15)
EMU 2004	0.03 (0.15)	0.33 (0.21)
EMU 2005	0.17 (0.17)	0.24 (0.15)
EMU 2006	0.16 (0.20)	0.27 (0.24)
EMU 2007	0.25 (0.21)	0.18 (0.21)
EMU 2008	-0.05 (0.22)	0.21 (0.19)
EU	0.37 (0.26)	-0.09 (0.22)
exchange rate volatility	-0.32* (0.16)	0.10 (0.12)
log(import)	0.23*** (0.08)	0.22** (0.08)
log(distance)	-0.24 (0.17)	-0.45*** (0.12)
colony	0.08 (0.21)	0.16 (0.20)
common language	0.43** (0.17)	0.20 (0.18)
border	-0.32** (0.14)	0.13 (0.18)
Constant	5.80* (2.91)	7.19** (2.85)
Observations	3332	3403
R-squared	0.90	0.92
Adj. R-squared	0.891	0.913

Estimations using OLS with robust standard errors clustered on the host country. * significant at 10%; ** significant at 5%; *** significant at 1%. All estimations include time fixed effects and time-varying source and host country fixed effects.

